

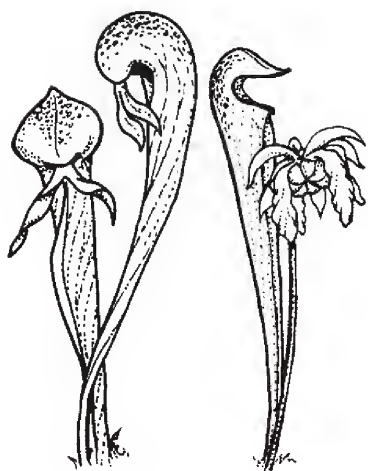
CARNIVOROUS PLANT NEWSLETTER

Journal of the International Carnivorous Plant Society

Volume 43, No. 1

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Front Cover: Ch'ien Lee in the habitat of *Nepenthes campanulata*, suspended approximately 200 m above the ground, on the rock face above Deer Cave in Gunung Mulu National Park, Sarawak. Ch'ien removed his safety helmet to pose for this photograph. Article on page 7.

Back Cover: Geoff Wong at the Bay Area Carnivorous Plant Society Show and Sale June 15, 2013. Geoff was talking about the *Utricularia quelchii* that he donated to the auction. Photo by Jeremiah Harris. Article on page 4.

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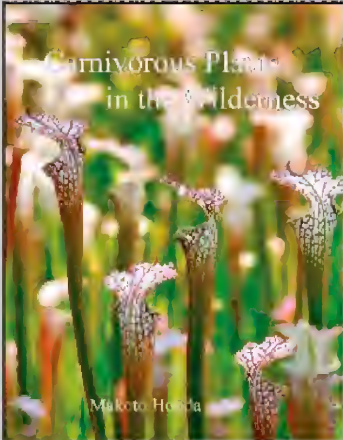
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IN MEMORY OF GEOFF WONG

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It is incomprehensible to me that I am writing this memorial article about Geoff Wong, who passed away on November 6, 2013, after a brief battle with cancer that took his life at the age of 62.

It was August of 1987 that I first met Geoff at the San Francisco Plant and Flower Show, where I was an unknown grower entering plants for the first time. That year Geoff was a judge and fortunately could not display any of his own plants. Had he done so I would not have won so many awards, I am quite sure. He was very excited to meet me, and showered me with compliments, not only on the quality of my plants but on their presentation using attractive and unusual pottery, as well as decorative rock crystals and various moss ground coverings. Presentation of things like carnivorous plants was very important to Geoff, as I soon found out. Geoffrey Wong was the supreme leader of such things.

An example of this I witnessed soon thereafter, when he hosted a gathering of the fledgling Bay Area Carnivorous Plant Society (BACPS) at his home, then in Palo Alto, where the yard itself looked like a botanical garden. With dramatic flair, he unveiled his latest hand-made terrarium (yes – he built the terrarium of metal and glass himself!) by removing the frontpiece of mylar and cardboard that he used to increase the grow light's reflection. The audience collectively gasped. It was like a window upon another world, a potted-landscaped terrarium, something I had never seen before. In the center was an exquisite *Nepenthes glabrata*, with ground as well as upper pitchers, and surrounding it other plants such as a clump of rosetted sundews, a Mexican butterwort, Venus Flytrap, and an extraordinary *Heliamphora* – all richly colored and flawless. When I asked how he could grow these various genera all together he explained how they were in individual pots of their preferred soil mix, and he filled the spaces between with peat and introduced mosses that he groomed and manicured to perfection. To this day it remains one of the most incredible carnivorous plant terrariums I have ever seen.

Geoff once told me he became obsessed with carnivorous plants after seeing a photo of *Cephalotus* while in college in Los Angeles. I believe it was the first species he obtained, quite possibly from the now defunct Plant Shop's Botanical Garden in Reseda, California, a legendary retail nursery he turned me on to. Years later he would win awards for his incredibly enormous pot of *Cephalotus* with more than one hundred yawning pitchers, grown by inserting dozens of leaves into the soil and then drumming his fingers for a couple of years until they turned into a dense mat of plants. Meticulousness and patience were two of Geoff's many virtues.

While he grew many plants, he was also extremely selective. He was not the type who craved every species and hybrid in existence. He had a few *Sarracenia* and sundews on a sunny porch at his later Victorian house in San Francisco, but space was limited. He converted a bedroom of the house to a grow room with various grow light chambers and terrariums, specializing in choice and challenging varieties such as *Nepenthes*, *Heliamphora*, and *Genlisea*.

Geoff's creativeness was amply shown with the latter mentioned genus. The photo of his corkscrew plant grown in a box of *Sphagnum* moss with the traps suspended in water below that appears in my book *The Savage Garden* and more recently in Andreas Fleischmann's monograph made him a household name among carnivorous plant growers.

Geoff's interests were not confined to flesh-eating plants. He grew many miniature orchids, brightly colored cacti, and bred albino mosquito fish so they could be seen in ponds. He shared all of



Geoff Wong. Photos by Robert Co.

these liberally with many friends. He once showed me a clavichord (an early keyboard instrument) he built from scratch. He was a great chef, once entertaining myself and friends to a French-Asian fusion meal complete with a green tea tasting. He chased eclipses around the world and took botanical trips to the Andes and Borneo and other exotic locations.

It was also Geoff who was responsible for Ch'ien Lee, a native Californian, moving to Borneo to pursue a life there, and discovering and re-discovering many of our most beloved *Nepenthes* as a result.

Geoff was also greatly involved with his enormous extended family of sisters, nieces, and cousins, enthralled them with his love of nature.

Upon his retirement from his job as a senior scientist for a biotech company a few years ago, Geoff happily told me he was busier than ever. He was a volunteer assistant to Kirsten Natoli, horticulturalist at the California Academy of Sciences in San Francisco, who raved about his work in a talk she gave at his well-attended memorial. His friendship with Judith Finn of the Berkeley Botanical Garden goes back decades, and he also had a long relationship with the Conservatory of Flowers. At California Carnivores, we have countless plants he has given us over the years.

But most importantly Geoff Wong's personality can be best described through a phone call I received from a distraught grower who called me upon hearing of his passing. As a newcomer to the hobby attending the 1999 ICPS conference in San Francisco, he felt that many old timers of some fame were nearly unapproachable – but not Geoff Wong. Geoff was always eager to welcome with open arms anyone who wanted to learn, sharing his knowledge with those who simply asked.

As he wrote in his deeply moving "Final Farewell", written on October 22, 2013, and read and distributed at his memorial:

“The greatest memorial that you can build for me lies within your own hearts. I ask each of you to carry on my life’s mission. Wherever you go, wherever you are, whomever you meet, whomever you are with, please do something that helps that other person grow and become a more complete person, and as you do so, please think of me.

“I now rest in peace.”

Goodbye, Geoffrey.

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OBSERVATIONS OF THE NATURAL HISTORY AND ECOLOGY OF *NEPENTHES CAMPANULATA*

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Keywords: *Nepenthes campanulata*, Borneo, Sarawak, limestone, prey, Palawan.

Abstract: *Nepenthes campanulata* is a little known species from limestone cliff habitats in Borneo. In this study, we conducted the first field-based survey of pitcher dimensions and the prey and invertebrate fauna in *N. campanulata* pitchers, sampled from plants growing on the cliff face above Deer Cave in Gunung Mulu National Park. We found that the dominant prey taxon is Diptera, followed by Formicidae. The metazoan community that inhabits the pitchers consists of just three species, making it one of the simplest in the genus. The pitchers of *N. campanulata* have a unique structure among *Nepenthes*, which may be related to the highly specialized habitat that the plant occurs in. Prior to this study, *N. campanulata* had been recorded at just two localities: Mt. Ilaa Bungan in East Kalimantan, and Gunung Mulu National Park in Sarawak. However, on a recent expedition to Palawan, we observed plants that we identified as *N. campanulata*, which represents a remarkable extension to the geographical range of this species.

Introduction

Nepenthes campanulata is one of the most unusual and poorly documented of all *Nepenthes* species. It is remarkable for the compact stature of the plant and its small, yellow, bell-shaped pitchers, which give the plant its species name (Fig. 1). In terms of pitcher structure, the most similar species appears to be *Nepenthes inermis* from Sumatra, but these similarities are superficial – the upper pitchers of *N. inermis* lack a peristome entirely, and the inner surfaces are entirely glandular, lacking a layer of wax crystals. By contrast, the pitchers of *N. campanulata* have a minute, toothed peristome and a well-developed waxy zone that covers most of the inner surfaces of the pitchers. As we shall see below, the structure of *N. campanulata*



Figure 1: Close-up of a *Nepenthes campanulata* plant growing on a sheer limestone cliff face above Deer Cave, Gunung Mulu National Park, Sarawak.

pitchers is in fact unique among *Nepenthes*, and the results of recent ecological research into the genus allows us to propose – for the first time – how they might have evolved.

Nepenthes campanulata was first described by Kurata (1973). The description was based on a specimen collected in 1957 by A.J.G.H. Kostermans (*Kostermans 13764*, SIN) that was deposited at the Singapore Herbarium. The type locality was stated as “Mt Ilas Bungaan” in eastern Borneo. According to Kurata (1973), Kostermans trekked for 14 days to reach Mt. Ilas Bungaan, the face of which was said to be “completely overgrown with flowers”. The “flowers” were in fact pitchers of *N. campanulata*. Until relatively recently, the precise location of Mt. Ilas Bungaan remained unknown to all but Kostermans. Eventually, the location was re-discovered, but recent visits to the type location (Mt. Ilas Bungaan) in eastern Borneo revealed that much of the vegetation on the mountain has been burned off, and no *N. campanulata* plants remained. As no other populations of *N. campanulata* were known at that time, it was thought that the species might be extinct.

In 1997, one of us (CL) discovered a population of *N. campanulata* in Gunung Mulu National Park in Sarawak. As with the type locality, the plants were found to be growing on steep limestone cliffs (Fig. 2). Remarkably, the distance between the Sarawak population and the type locality was over 400 km, with no obvious sites in between that could feasibly be colonized by *N. campanulata*. In 1998, voucher specimens were obtained from the Mulu site and deposited in the Kuching Herbarium (Borneo, Sarawak, Taman Negara Mulu, Batu Pajing, *C. Lee S 87440* (SAR); *C. Lee S 87441* (SAR)). Subsequent expeditions to Gunung Mulu National Park by C. Lee revealed that *N. campanulata* grows on several sheer limestone cliffs there, but nowhere easily accessible, with all plants growing between 100-300 m above sea level.

Within this habitat, *N. campanulata* is apparently quite specialized, and has been observed to grow only on sections of the cliff, which are rarely exposed to rain. These sites are easily distinguished by the white color and relatively smooth surface of the rock as opposed to a gray and often sharply eroded surface. Such zones remain dry either due to the overhanging angle of the cliff or the fact that rain predominantly blows from a direction which does not often strike the vertical face. Plants of *N. campanulata* typically grow with their roots embedded within spongy, often moist, tufa formations, and therefore must derive much of their water from that which seeps through the limestone.

Although *N. campanulata* has been rediscovered and its habit and habitat observed through binoculars and telephoto lenses, many aspects of its natural history have yet to be documented, because of the extreme challenges associated with physically reaching the plants on the high, vertical cliffs



Figure 2: Plants of *Nepenthes campanulata* growing on the limestone cliff near the entrance of Deer Cave in Gunung Mulu National Park, Sarawak.

Table 1. Average dimensions of <i>Nepenthes campanulata</i> pitchers.		
Pitcher characteristic	Mean	Standard deviation
Capacity (ml)	24.06	11.77
Height (mm)	9.31	1.80
Orifice diameter (front to rear) (mm)	3.68	0.94
Orifice diameter (side to side) (mm)	4.19	0.86
Lid length (mm)	3.44	0.80
Lid width (mm)	2.92	0.57
Hip position (distance from base to hip) (mm)	3.74	0.61
Hip diameter (front to rear) (mm)	2.37	0.46
Hip diameter (side to side) (mm)	2.44	0.51

on which they grow. For several years, it seemed that the logistical challenges to studying this plant in the wild could never be overcome, but in 2011, we had a unique opportunity to study *Nepenthes campanulata* in its natural habitat.

During filming for a television documentary, a film crew managed to abseil down the cliff above Deer Cave to film millions of free-tailed bats emerging from the cave at sunset. Several plants of *N. campanulata* grow on this cliff face, and as one of us (CL) also has the necessary skills and experience to abseil down this cliff, we managed to obtain permission to visit these plants and collect the contents of some pitchers, so that we could learn more about what sorts of insects *N. campanulata* traps, and what sorts of animals live in its pitcher fluid.

In addition, during a recent field trip to Palawan in the southern Philippines, we observed plants growing on limestone cliffs that we identified as *N. campanulata*. This represents a remarkable extension to the geographical range for this species, and gives us cause to reconsider the phytogeographic relationships between Borneo and Palawan with regards to the evolution and diversification of *Nepenthes*.

Methods

The habitat of *N. campanulata* is virtually inaccessible to humans. Aside from a small number of stray plants, the majority of plants grow approximately 200 m above the ground on sheer limestone cliffs above the entrance to Deer Cave in Gunung Mulu National Park. The only way to reach them is to abseil down to them from the top of the cliff, some 50 m above the plants. The undulating surface of the rock, along with sharp ridges and shelves, makes this a perilous activity. To survey the plants in their natural habitat, rope lines were anchored near the top of the cliff and Ch'ien abseiled down to the plants (Front Cover). Due to the slightly overhanging slope, it was necessary to use multiple anchor points down the cliff face in order to stay in close proximity with the rock. After surveying the plants and obtaining prey samples, Ch'ien ascended the fixed lines back to the top of the cliff.

A total of 17 *N. campanulata* pitchers were observed, measured, and their contents analyzed using a Nikon Stereomicroscope. Identifiable prey were sorted, counted and identified to Order. Infaunal organisms were identified to genus (or species) where possible. The food web diagram was drawn in accordance with the methods of Clarke & Kitching (1993). Pitcher dimensions were measured to the nearest mm, using the methods of Chin *et al.* (2010).

Field work was conducted in accordance with Sarawak Forestry Permit Number 22/2011. Permission to abseil down the cliff face above Deer Cave was granted by the management of Gunung Mulu National Park.

Results & Discussion

Pitcher dimensions

The pitchers of *N. campanulata* are comparatively small (Table 1), with a height similar to that of *N. gracilis* pitchers (Clarke & Kitching 1993). However, the average (± 1 S.E.) capacity of *N. campanulata* pitchers appears to be somewhat greater than *N. gracilis* (24.06 ± 2.68 ml versus 14.40 ± 1.17 ml ($n = 20$)), due to the bell-shaped structure of *N. campanulata*. The waxy zone of *N. campanulata* pitchers extends from the orifice down to the hip, which is located approximately one third of the way up from the base. The position of the hip, coupled with the narrow dimensions of the pitcher in the lower third, strongly constrains the volume of fluid that the pitchers can accommodate. Although we were unable to accurately measure pitcher fluid volumes, these appear to be consistently less than 5 ml.

Prey capture

N. campanulata traps mostly small flies and ants, along with the occasional beetle, cricket, or moth (Fig. 3). This prey-capture profile is typical for a species with small, yellow pitchers that are produced at or above canopy level (Moran 1996; Bonhomme *et al.* 2011). However, it is highly atypical for a species that has a reduced peristome and well-developed waxy zone. The small peristome/well-developed waxy zone character combination has been referred to in recent ecological studies as “dry type”. The pitchers of most *Nepenthes* species can be divided into two groups, called “wet type” and “dry type” (Bauer *et al.* 2012; Moran *et al.* 2013). Wet type pitchers tend to have a broad peristome and a reduced (or no) waxy zone. The peristome relies on moisture to function, and so species with “wet type” pitchers are confined to habitats that are almost permanently moist. By contrast, dry type pitchers have narrower peristomes and well-developed waxy zones. While the peristomes of dry type pitchers are less effective than those of wet type ones, the waxy zone remains effective even if the weather is dry. Furthermore, the wax crystals are better at retaining water than glandular surfaces, so dry type pitchers are more efficient in places where occasional, short term water deficiencies occur.

One thing that is intriguing about the prey caught by *N. campanulata* pitchers is that dry type pitchers are thought to be more effective

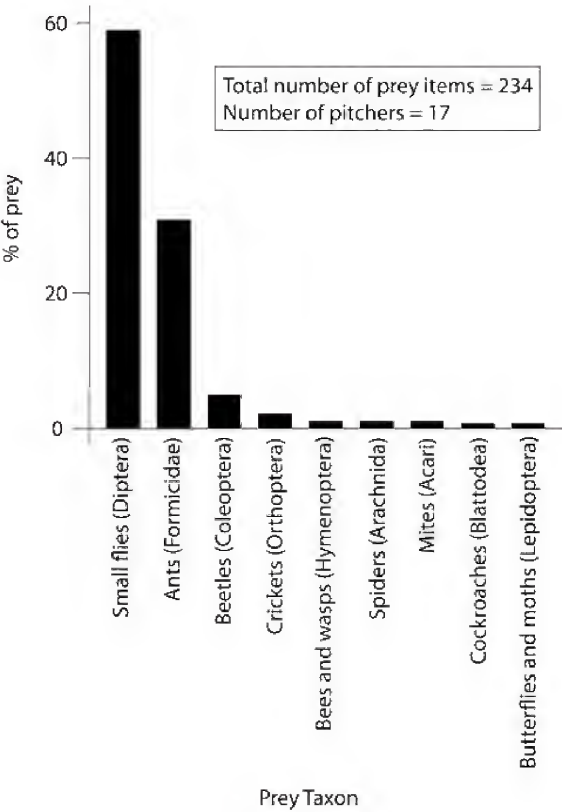


Figure 3: Histogram showing the proportional composition of arthropod prey taxa in *Nepenthes campanulata* pitchers.

at trapping crawling prey, such as ants, and less effective at trapping flying prey, such as small flies (Bonhomme *et al.* 2011; Bauer *et al.* 2012; Moran *et al.* 2013). In this respect, our findings for *N. campanulata* pitchers are counter-intuitive and suggest that the dry-type pitcher format may also be highly effective at trapping flying prey. Moran *et al.* (2013) contend that the geographical distribution of trap types is governed solely by climate. Our findings support this assertion – most likely, the structure of *N. campanulata* pitchers reflects the highly specialized environment that *N. campanulata* occurs in, rather than specializations to target any specific type of insect prey.

It should be noted that our sample size is small, and our observations were based on a single sampling event, so there is potential for error in our findings and interpretations. That said, similar sample sizes have been used in other surveys of prey capture by *Nepenthes* and we feel that our results are likely to be representative, at least as far as rates of capture of Diptera and Formicidae are concerned. While there is a patent need for further, more detailed observations of prey capture by *N. campanulata* pitchers, the logistical challenges to doing this are extreme, and at present, there is little chance of these being overcome.

Invertebrate fauna

With only three species, the metazoan infauna of *N. campanulata* pitchers is one of the simplest recorded to date (Fig. 4) (Beaver 1985). Larvae of the mosquito, *Tripteroides nepenthis*, feed on the remains of captured insects, breaking down the carcasses and increasing the rate of digestion of prey. This species is a common inhabitant of lowland *Nepenthes* pitchers in open, disturbed habitats throughout Borneo, as are mites of the genus *Zwickea*. Somewhat surprisingly, we found that *N. campanulata* pitchers are also colonized by a species of *Toxorhynchites*, whose larvae are predators, feeding on the larvae of other mosquitoes and midges. Although the pitchers of several *Nepenthes* species from Borneo are colonized by *Toxorhynchites*, these larvae are generally found only in pitchers of *Nepenthes* species that have a rich infaunal community that contains several other mosquito and midge species. It remains to be seen whether *Toxorhynchites* is a regular colonist of *N. campanulata* pitchers, or whether it is an “accidental” colonist – with gravid females occasionally laying their eggs in *N. campanulata* pitchers, rather than larger congeners from nearby habitats, such as *N. faizaliana*, *N. reinwardtiana*, *N. ampullaria*, and *N. bicalcarata*.

Of the 17 pitchers we examined, nine had no metazoan infauna and a further two were colonized only by *Zwickea* sp. mites. Compared to other lowland *Nepenthes* species from nearby Brunei, this is an extremely low rate of pitcher colonization (Clarke & Kitching 1993) and is similar to pitchers from sites that are the most marginal for infaunal organisms. This result suggests that the environment in which *N. campanulata* grows is extremely challenging for invertebrate larvae, and that only the most resilient species are able to colonize and persist in them.

The geographical range of *N. campanulata*

N. campanulata pitchers represent an extreme development of the dry type pitcher format. The peristome is reduced to such an extent that it is barely visible, but the waxy zone is very highly developed. This makes the pitchers

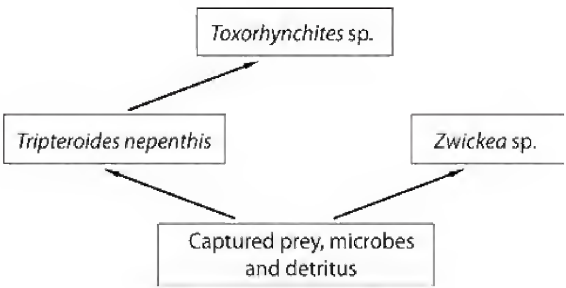


Figure 4: Summary metazoan food web for *Nepenthes campanulata* pitchers. Boxes represent metazoan species or sources of nutrition. Arrows show the directional transfer of energy/nutrients from one trophic level to the next.

effective arthropod traps even when the weather is comparatively dry. Water loss from pitchers is minimized by reducing the digestive zone to a small area at the bottom of the pitcher, with a correspondingly small quantity of pitcher fluid. In other words, most of the surface area of the trap is devoted to capturing and retention of prey, whereas only a small part is devoted to the digestion of prey. The bell-shaped structure does not prevent rainfall from entering, but because the plants often grow beneath overhangs on the cliff face, they rarely receive large quantities of direct rainfall, so a bell-shaped pitcher with a small lid is not a disadvantage. These pitcher characteristics are instructive with regards to the niches that *N. campanulata* colonizes on limestone cliff faces. If *N. campanulata* grew on the most exposed parts of the cliff faces, the pitchers would often overflow whenever it rains, and the plants would be subjected to far greater water stress during dry spells. By growing beneath rocky shelves (whose surfaces stay moist longer than in exposed sites) the pitchers are protected from direct rainfall.

Few limestone escarpments in Borneo have cliffs with the type of shelves and overhangs that *N. campanulata* colonizes, which is why the recorded range of this species is not greater (Fig. 5). However, a wider geographical range within Borneo is possible, for two reasons: (1) large areas of karst terrain exist in eastern Borneo, and few of these have been explored in any detail for *Nepenthes*, and (2) *N. campanulata* only colonizes sites with a specific combination of features (see above). Cliffs that lack these features are devoid of *N. campanulata* plants, and probably always have been.

In July 2013, during an expedition to Palawan, we surveyed a number of sheer limestone cliffs that form part of the Saint Paul formation, which seemed to possess similar characteristics of the



Figure 5: The extraordinary habitat of *Nepenthes campanulata*. Note the angle of the cliff face, which slopes inwards.



Figure 6: Plants that we identified as *Nepenthes campanulata* growing on a limestone cliff in the Saint Paul limestone region of Palawan.

cliffs at Gunung Mulu National Park above Deer Cave (including being several hundred meters in height!). Scanning the cliffs with binoculars, we found a *Nepenthes* growing in precisely the same habitat niche as *N. campanulata*. Furthermore, the plant stature and growth habit, leaf shape, short tendrils, and bell-shaped pitchers corresponded to *N. campanulata*. Although we were unable to get close enough to the plants to make detailed observations of minor morphological characteristics (Fig. 6), we concluded that they represent *N. campanulata*. Of course, it is feasible that closer examination of these plants could show them to be an undescribed, closely related species, but we are comfortable with our identification, which allows the Palawan populations to be included in existing frameworks for conservation assessments (such as the IUCN Red List). We acknowledge that our identification of these populations is likely to cause debate, but we view that as a good thing and look forward to seeing our judgment put to test in the near future!

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CEPHALOTUS FOLLICULARIS CULTIVARS AND FORMS IN CULTIVATION — IS THERE A BASIS FOR THE CURRENT NAMING PROTOCOLS?

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Keywords: *Cephalotus follicularis*, cultivation, cultivar.

Over the past few years the author has watched with interest as cultivators of *Cephalotus follicularis* have attempted to find some points of difference to apply cultivar names, some registered, most not. Unfortunately, in what appears to be a push for commercial gain, the current plethora of cultivar names has reached the point of ridiculous, and one which unfortunately is also gaining popularity with other genera of carnivorous plants. Human nature is such that when we get bitten by the collecting bug we want to have every species or variation of it in our collections and I fear that this is now occurring with *C. follicularis*. The objective of this article is to try and bring some common sense to the naming of *C. follicularis* forms and preventing collectors from wasting their money on dubious and spurious forms and cultivars of this plant. Having, over the past 30 years cultivated this genus (with varying levels of success) and in the past decade documented and photographed this plant in multitudes of locations in its natural habitat, I feel that I have some basis for passing comment on this topic. The assertions in this article are my own views, but are supported by similar views of authorities such as Phill Mann, Allen Lowrie, and Greg Bourke, who have seen and studied *C. follicularis* at multiple locations in its natural habitat and cultivated many clones of this plant.

For a number of years Phill Mann and I have been trying to find stable variations in *C. follicularis*, but in cultivation they always tend to revert to the mean, and plants from different sites that looked different in the field (see figures) tend to all end up looking pretty similar in the same conditions. Sure some plants color up a bit more and others might produce a larger pitcher, but it is often not the most colorful or largest pitchers from the field that translate into these specimens in cultivation. I think it is worth noting that any collected specimens were done legally under permit and only cuttings taken so as not to remove any plants. A simple comparison between *C. follicularis* and *Dionaea* and *Sarracenia* cultivars shows that the latter hold true to form when basic conditions such as light, temperature, and water levels are met, i.e. a *Sarracenia* 'Adrian Slack' tends to look the same for most growers who have a basic idea of how to grow them, the same cannot be said for *C. follicularis*. Sure if you want to grow them under high intensity



Figure 1: *Cephalotus follicularis* photographed at Torndirrup National Park. This plant produces particularly robust and large pitchers in the field. Perhaps it is the parent of *Cephalotus* 'Hummer's Giant' or is it just a plant that is growing in favorable conditions?



Figure 2: *Cephalotus follicularis* photographed at Broke Inlet (left) and at Donnelly River (right).



Figure 3: Two plants of *Cephalotus follicularis* showing different coloration photographed on the Denmark – Mt. Barker Road.

light they will color up and some will show different shades to others, but this is not how they grow in the field.

Having seen many natural sites and cultivated plants over the years, the conclusion I arrive at is that *C. follicularis* is very reactive to its micro habitat. There are some broad generalizations that hold true, in bright light the plants will color up and the pitchers tend to be smaller and more robust, in shade the pitchers can attain impressive dimensions and tend to stay green or lightly colored. However, to add to the confusion, plants in the field have been observed that behave in the opposite manner. In fact, at most sites in the wild, *C. follicularis* can be quite variable in terms of color, pitcher size, and growth habit. Often two plants growing next to each other will have different color and size. So what causes this variation, is it genetic or is it the micro habitat variables, such as nutrients, water, light, substrate, and temperature variation, all of which can vary subtly across one individual location? To be clear, the scientific research hasn't been carried out to answer this conclusively. However, my observations, and those of others that have significant knowledge of this species



Figure 4: Plants showing deep red color due to constant exposure to sunlight at Coalmine Beach. The image on the right has a plant growing in the same light, but hasn't taken on the same level of coloring, which is likely due to subtle differences in nutrients rather than genetic variation.



Figure 5: *Cephalotus follicularis* growing in unusual conditions at Northcliffe in pure sand, which reflects the sunlight. Consequently, the plants are highly colored and the pitchers are smaller due to the harsh conditions.

both in its natural habitat and in cultivation, would point towards differences being environmentally induced rather than genetically.

Currently there are three registered *C. follicularis* cultivars, 'Eden Black', 'Hummer's Giant', and 'Clayton's T Rex', all of which I would question the validity. In no way do I want to down play the work done by the authors of these cultivars. I think we would all like to believe there are different forms of *C. follicularis* worthy of our collections; however, I have always been skeptical, because fundamentally *C. follicularis* differences are unstable in cultivation. They may hold true for one grower with unique conditions and for the next with good, but slightly different growing conditions, they won't color up or the pitchers will only be of an average size.



Figure 6: Two large plants of *Cephalotus* growing in the Torndirrup National Park. These images highlight the variability of *Cephalotus* at the same site in the same light conditions. Tests in cultivation suggest that these color and pitcher size traits are not stable and are extremely reliant on the microhabitat around the plant.



Figure 7: A plant photographed at Mount Frankland National Park (left) and a deeply colored plant growing in the Two Peoples Bay area (right).

Along the same lines is the disturbing emergence of names such as “Big Boy”, “German Giant”, “vigorous clumping”, and “squat”. These names are just simply not valid and there is enough evidence on the web to suggest that growers are struggling to find much difference in these clones in their conditions. The bottom line is they aren’t stable and people are wasting their money.

Where things have got really stupid is the emergence of names such as “Phill Mann” or “Allen Lowrie” being put on these plants and people actually collecting them. I can understand collectors putting the source of their plants on the back of the label, but to actually use this as a point of difference is ridiculous. In fact, most of the original clones of *C. follicularis* in cultivation today originated from Allen or Phill some 30 plus years ago, others would have been from plants collected by botanic gardens. Either way, the provenance of these plants is patchy to say the least. Let’s use *C. follicularis* “Phill Mann” as an example. Over many years Phill has built up stock from legally collected cuttings (that means under permit) from plants from many sites. I have been in his greenhouse and they are all mixed up. Same story with Allen Lowrie, (again from legally collected cuttings)

who clearly markets his plants as from a mix of multiple clones and sites. So if you are buying a piece of plant that has been labeled “Phill Mann” or “Allen Lowrie”, which clone are you getting, what location is it from? No one really knows. This is hardly a sensible way to categorize cultivars of *C. follicularis*.

It is easy to sit here and criticize attempts to categorize or split out different forms of *C. follicularis* without offering an alternative. I therefore propose that there is a more sensible approach to this issue. We are now seeing a few plants with location names entering cultivation, plants such as “Coalmine Beach” and “Two People’s Bay”. The problem for collectors is that the collection of these plants from the wild is strictly regulated and only a very few people have the necessary permits, particularly as the majority of *C. follicularis* sites are in National Parks. It will require some patience for properly named location clones of *C. follicularis* to enter cultivation, but over time it will happen. Knowing the provenance of a plant is valuable for several reasons, not least being that if a site is destroyed by man-made activity or act of nature, then we have a back-up in cultivation of genetic material that would otherwise be extinct. Also we know that *C. follicularis* is not stable in cultivation and it would make for interesting comparisons if collectors could discuss the variations in their plants from the same location. This is the same naming protocol that has taken hold with other genera of CPs. Specifically, *Sarracenia* and *Nepenthes* have been classified in cultivation using location names for some time.

I have no doubt this article will raise some debate, but I hope that some sanity will prevail and that the current naming of *C. follicularis* forms, which cynically seems to be aimed at commercial gain, will not take hold. Also the scientists in the CP community will probably criticize the lack of true research and data to support the claims in this work, but perhaps also it might encourage more detailed field research to unlock the secrets of this enigmatic species.



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A TRIP TO MOUNT TRUS MADI – THE *NEPENTHES* WONDERLAND

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Keywords: *Nepenthes*, Mount Trus Madi, Sabah, Borneo.

As a carnivorous plant enthusiast, have you ever wondered what it is like to be in a deep tropical jungle with plenty of wild pitcher plants dangling and scrambling around? Well then, prepare to stretch your imagination and let me share with you my journey to Mount Trus Madi. A place I call a *Nepenthes* wonderland.

Located in Sabah and standing at 2642 m above sea level, Mount Trus Madi is the second highest mountain in Malaysia. My four-day trip in May 2013 was part of a botanical and ecological exploration in the Trusmadi Forest Reserve, in which this mountain is located. We started hiking early in the morning from the Kaingaran Trail starting point at 1631 m a.s.l. The distance to the summit from this point is about 4.9 km. At the moment, this trail is closed to public due to upgrading of some tourism facilities.

After less than an hour of hiking, we found our first pitcher plant beside the boardwalk. It was a dainty little *Nepenthes tentaculata* (Fig. 1) creeping on the mossy forest floor. The plant can be easily identified by its signature tentacle-like hairs on its lid and diamond-shaped mouth. This species is so abundantly seen throughout the entire trail that you could hardly avoid from stepping on them unintentionally. They were either climbing on the treelets or creeping on the mossy ground. The pitcher sizes we saw ranged from as small as 1 cm to 13 cm in length. Their colors appeared in various hues, including yellow, green, red to dark purple.

A clump of *Nepenthes stenophylla* (Fig. 2) was found growing terrestrially at 1700 m a.s.l. It only had two pitchers with the biggest one measuring about 20 cm in length. The cylindrical pitchers with beautiful dark purple streaks have a round lid and rounded boss at the base of the lid, which are the distinctive features of this species. That is the only clump I found along the summit trail. Over



Figure 1: *Nepenthes tentaculata*.



Figure 2: *Nepenthes stenophylla*.

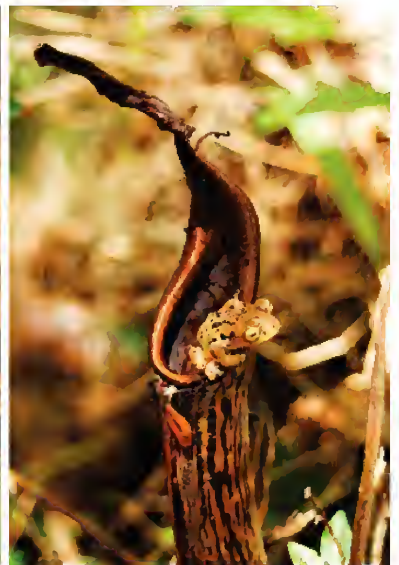


Figure 3: A small montane bush frog perched on the rim of *Nepenthes fusca*.



Figure 4: *Nepenthes lowii*.



Figure 5: *Nepenthes macrophylla*.



Figure 6: *Nepenthes* × *trusmadiensis*, a natural hybrid between *N. lowii* & *N. macrophylla*.

the next few days, I found another *N. stenophylla* on a ridge top at the same approximate elevation on a different area of the reserve.

Instead of focusing on the trail path I was on, my eyes were all over the forest ground and the tree tops looking for *Nepenthes*. The stunted trees and the damp ground in this tropical montane forest were literally enveloped with thick layers of mosses. The air was comfortably chilly at about 20°C and was occasionally misty. Combined with complete silence and low lighting, I found myself in a mystical and beautiful surrounding.

At the 1962 m elevation ridge top, the area is more exposed and sunny. All of us were captivated by a striking red flower blossom of *Rhododendron fallacinum*, a Sabah endemic plant. On this ridge top, I also found a *Nepenthes fusca* shrub. There were only two pitchers and they were almost dried out, measuring about 15 cm long. We cut the plant tip with one pitcher attached for our specimen collection. It is part of my routine to inspect the content of the pitcher before emptying it out. All of a sudden, I let out a loud shriek when I found myself just centimeters away from a tiny frog inside the pitcher! Throwing away the pitcher startlingly was part of the reflex and my tripmate nearly fell off the ridge. After we had a good laugh at it, I asked him to place the frog on the *N. fusca* peristome so we could shoot a great picture (Fig. 3). This photogenic frog could likely be *Philautus aurantium*, a small montane bush frog endemic to Borneo.

Hiking up to the higher elevation, the temperature was getting cooler and the vegetation is gradually changing to shorter and stunted plants, called mountain scrub. The gnarled and twisted trees along the ridge top trail seem like an exquisite bonsai garden. The entire air was a complete white thick fog and it shortened our vision. I felt like walking above the cloud in a mysterious garden.

Here, I discovered several big astonishing bunches of *Nepenthes lowii* hanging down from the stunted trees! They have the most distinguished pitchers due to their peculiar shape (Fig. 4). The sturdy narrow-waist pitchers are up to 25 cm long, mostly green on the outside and deep red inside. It was such a joyful find that my weariness after 7 hours of trekking had disappeared. I then truly understood how *Nepenthes* got its name; from the drug-of-forgetfulness called ‘*nepenthe*’ by the world renowned botanist, Carl Linnaeus in 1897.



Figure 7: The trail in the mossy forest.



Figure 8: Mount Kinabalu seen at the north horizon from the ridge top summit trail.

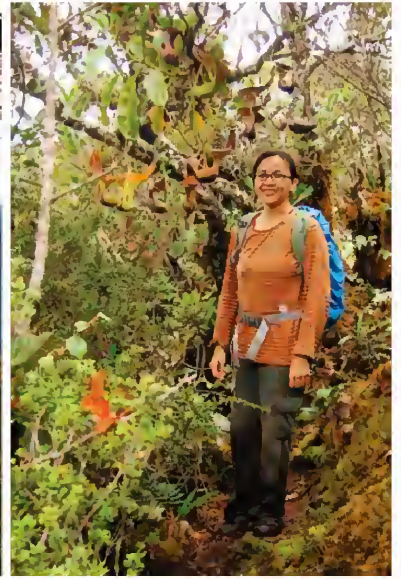


Figure 9: Author with a bunch of *N. lowii* hanging above.

We dawdled through the beautiful natural surroundings. Our laggard group arrived at the Gibon cabin at 4:30 pm. We spent a cold and damp rainy night, with a temperature of about 14°C and 99% humidity in the cabin, which could fit 18 people. We planned to wake up as early as 4 am to catch the sunrise at the summit. Unfortunately, when we awoke, it was still drizzling. We then began another 1.5 km journey to the peak at about 6 am.

While I thought I had seen the forest as beautiful as it could be the day before, the trail to the summit was even more spectacular. Within just 10 m of the cabin, I saw some amazing epiphytes of *Nepenthes macrophylla* and a natural hybrid *Nepenthes* × *trusmadiensis* (*N. lowii* × *N. macrophylla*). Both species are endemic and exclusively found only on this mountain.

The broadly cylindrical pitchers of *N. macrophylla* are up to 35 cm long and have an impressive peristome with a series of vertical flanges (Fig. 5). The colors range from bright red to orange. Together with *N. lowii*, these fine Borneo pitcher plants occur in the deep mossy forest and the bonsai garden. Their countless amazing pitchers were dangling all over the area like Christmas ornaments. The scene was truly an enchanting *Nepenthes* garden!

Unlike its abundant parents, the *N. × trusmadiensis* was not that easy to spot. We only managed to find two along the way, about 800 meters apart. One of which was a ground scrambler (Fig. 6) that produced a large pitcher of about 40 cm long, from base to reflexed scoop lid.

The trail was quite challenging (Fig. 7). Some knee-shaking steep parts required us to climb up with a rope, occasionally pulling and stepping on exposed tree roots. The path was also boggy and the clumsy members of our team often tripped when accidentally stepping on slippery rocks or roots. In spite of this, we were lucky to have a clear bright sky that enabled us to view the breathtaking panoramic scenery from the ridge top. The famous majestic Mount Kinabalu could be seen standing on the northern horizon, about 50 km away from where we stood (Fig. 8). We finally reached the summit of Mount Trus Madi at 10 am.

Trekking down to the cabin was faster, which took us only about 2 hours. After we had lunch and packed our belongings, we quickly went down and raced against time to reach the starting point before it got dark at 6 pm.

As we headed home a few days later, I looked back at the mountain and smiled gratefully, enriched with my wonderful experience. The Mount Trus Madi trip is one of the most memorable adventures I have ever had and I will always remember it as a *Nepenthes* wonderland.

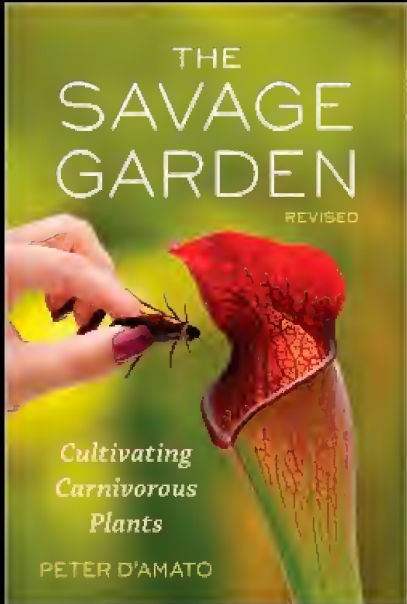


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NEW CULTIVARS

Keywords: cultivar: *Dionaea muscipula* ‘Kayan’, *Dionaea muscipula* ‘Phoolan Devi’, *Drosera* × *californica* ‘Portland Sunrise’, *Sarracenia* ‘Black Jaw’, *Sarracenia* ‘Black Mamba’, *Sarracenia* × *moorei* ‘Silvia Luise’.

Sarracenia × *moorei* ‘Silvia Luise’

Submitted: 13 October 2013

Sarracenia × *moorei* ‘Silvia Luise’ is a *Sarracenia* × *moorei* that I made in 2008 by crossing a copper tinged *S. flava* var. *rugelii* with a typical form of *S. leucophylla*. This plant has the same color and shape of *S. leucophylla*, except for a very bright pink patch on the “neck” of the pitcher. It is different from similar clones of *S. × moorei* having a pink neck because of the particular coloration: there is not one big pink blot on the neck, but there are two patches divided from the central nervation of the leaf that is white, as is the rest of the pitcher (Fig. 1). The adult plant is about 70-80 cm tall with pitchers 4-5 cm wide. The flower is light red/orange. In spring, it produces smaller and not very colorful pitchers.

I named this cultivar Silvia Luise in September 2010 as a dedication to the most important woman in my life, my friend, and my girlfriend.

Sarracenia × *moorei* ‘Silvia Luise’ must be reproduced vegetatively to preserve the characteristics of the cultivar.

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Figure 1: *Sarracenia* × *moorei* ‘Silvia Luise’ pitchers.

Sarracenia ‘Black Jaw’

Submitted: 17 November 2013

Sarracenia ‘Black Jaw’ is a hybrid (*Sarracenia rubra* subsp. *gulfensis* × *S. leucophylla*) × (*S. leucophylla* × *S. rubra*). The pitchers grow vertically. The rhizome has a horizontal spread. The upper part of new pitchers is green/pink with white areolas, becoming pink with pink veins and white areolas as they become older (Fig. 2). The pitcher opening becomes increasingly dark red with a silky black border inside the operculum – the most important feature of this cultivar. The areolas eventually turn a deep pink color. The operculum points upward with jagged edges. Veins are evident only in the juvenile stage, and then become the same red color of the upper part of pitcher. The maximum pitcher height is 60 cm and the width is 4.5 cm at the lip. The back of the operculum merges with the pitcher. The pitcher exterior is pubescent.

I coined the name ‘Black Jaw’ in September 2013 because the persistent characteristic black color around the lip of the pitcher’s mouth and in the inner side looks like it has a black jaw.

Cultivation is the same as with other *Sarracenia*. This hybrid is winter-hardy; it has survived -5°C without damage. Vegetative propagation is necessary to maintain the unique features.

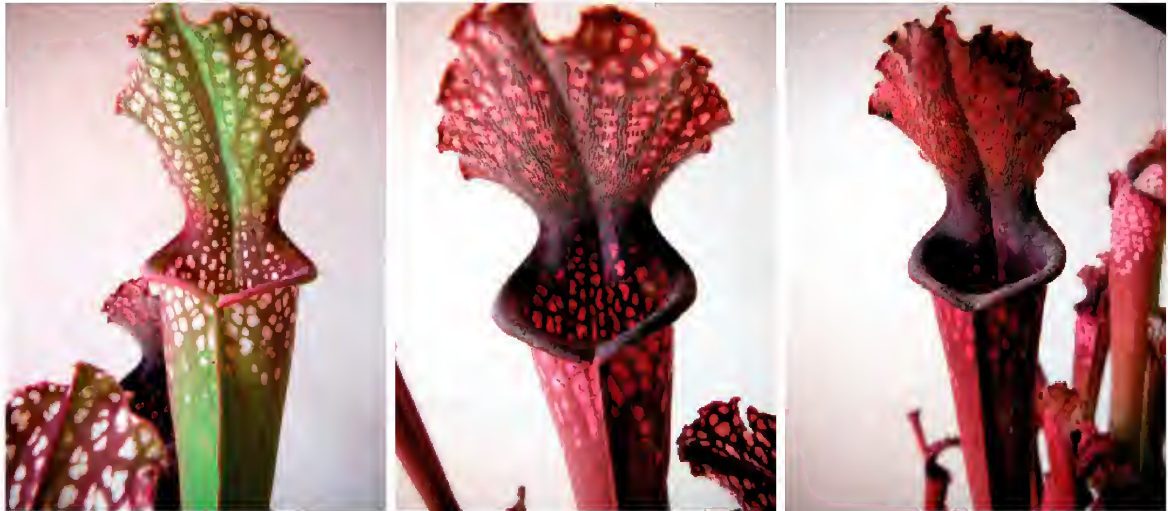


Figure 2: *Sarracenia* ‘Black Jaw’ early, middle, and late pitchers (left to right).

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Sarracenia ‘Black Mamba’

Submitted: 22 September 2013

Sarracenia ‘Black Mamba’ is a hybrid of *S. leucophylla* “red & white (L23MK)” × *S. alata* var. *nigropurpurea* “stocky pubescent, De Soto National Forest (A28MK)”. Both parents are originally from Mike King. *Sarracenia* ‘Black Mamba’ was created by Vincenzo Castellaneta who gave the plant to me in September 2012.

I grew my plant for 12 months to see if its characteristics were stable under growing conditions different from those of the hybridizer. This spring, the plant emerged from dormancy and, to my delight, the distinguishing features were identical to those observed a year ago.



Figure 3: *Sarracenia* 'Black Mamba' early pitcher (a, b) and late pitcher (c).

Sarracenia 'Black Mamba' has a rhizome colored with anthocyanins. The pitcher is erect without folds as it develops. Early pitchers are initially green and light red (Fig. 3a). The growing pitcher begins to form many fenestrations from a few centimeters below the lip to the neck. Two red spots, well separated from fenestration, can be seen on the sides of the neck within the pitcher opening above the operculum. Abundant dark red veins extend to the middle of the pitcher (Fig. 3b).

After a few days in the sun, the underside of the operculum, neck, lip, and throat begin to darken more and more each day, until it becomes a very dark red, appearing almost black (Fig. 3c). The pitcher is pubescent and produces a good quantity of nectar.

This cultivar is named because at first glance it looks like the mouth of a "black mamba" snake trying to bite its prey — in fact, the inside of the mouth of this dangerous snake is very dark.

Sarracenia 'Black Mamba' must be reproduced vegetatively to preserve the characteristics of the cultivar.

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Dionaea muscipula 'Phoolan Devi'

Submitted: 23 November 2013

Dionaea muscipula 'Phoolan Devi' is a white Venus Flytrap. In spring, the leaves are green and then they turn white during summer (Fig. 4). Discovered in 2009, this plant has been called by the unregistered local name *Dionaea muscipula* "Pâle".

I selected the name for Phoolan who was born in rural India, in a poor family belonging to the Mallaah caste. Married to a much older man at an early age, she was branded as a social outcast after she left her husband to escape marital mistreatment. A family feud resulted in her arrest and made her a victim of police brutality, which greatly embittered her. She was kidnapped by a gang of bandits, who had been paid to kill her. Subsequently, she married one of them, Vikram Mallah, who protected her from a rape attempt by the gang leader, and became part of the gang. With Vikram as the new leader of the gang, the group punished Phoolan's ex-husband, and carried out several robberies. Later, a group of bandits belonging to the Thakur upper-caste murdered Vikram and gang-



Figure 4: *Dionaea muscipula* 'Phoolan Devi' in early spring, middle spring, and summer (left to right).

raped Phoolan. After escaping from their captivity, she raised a Mallah-dominated gang, which carried out a series of violent robberies. She gained a fearsome reputation as the “Bandit Queen”, and some villagers started calling her an incarnation of the Hindu goddess Durga. Some people saw her violence as the lower castes’ retaliation against the cruelty of the upper-castes. In 1983, she surrendered and was sent to prison for 11 years. After her release, she contested elections as a candidate of the Samajwadi Party, and was elected to parliament in 1996. On July 25, 2001, she was shot dead outside her home by masked men from upper-caste.

When she was a little girl, Phoolan used to climb in a very big Neem tree (*Azadirachta indica*) and the flowers of this tree are pure white with some yellow green darker color in the center. So it reminds me of this *Dionaea* and I give it the name of this amazing woman.

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Dionaea muscipula ‘Kayan’

Submitted: 23 November 2013

Dionaea muscipula ‘Kayan’ is a Venus Flytrap with a very long neck that can reach 2.5 cm between the leaf and the trap (Fig. 5). The neck (petiole) may be similar in *Dionaea* ‘Crested Petioles’, but in this cultivar the neck is not always as elongated as in *D.* ‘Kayan’. Another plant with a long neck is *Dionaea* ‘Trichterfalle’, also known as ‘Funnel Trap’, but this cultivar has cupped traps.

The Kayan are a subgroup of the Red Karen (Karenni) people, a Tibeto-Burman ethnic minority of Burma (Myanmar) in Northern Thailand. In this group women wear the brass neck coils and their neck is very long. So when I selected the name for this new cultivar I thought about those women and the name of their tribe.



Figure 5: *Dionaea muscipula* ‘Kayan’.

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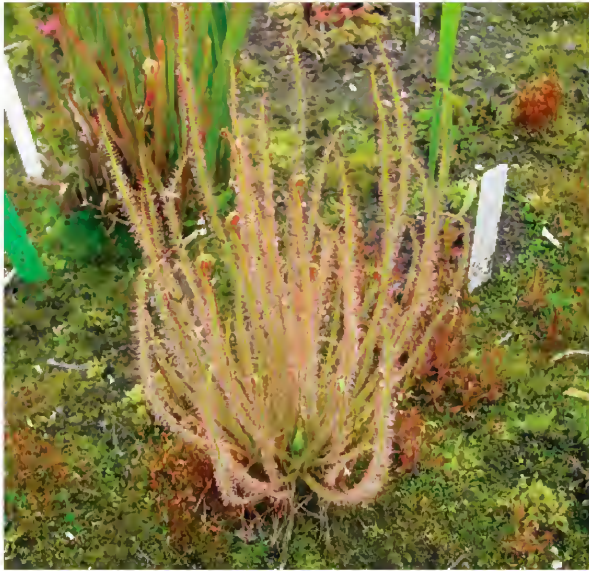


Figure 6: *Drosera x californica* 'Portland Sunrise'.



Figure 7: *Drosera x californica* 'Portland Sunrise' taking over a back yard bog near Portland, Oregon.

Drosera x californica 'Portland Sunrise'

Submitted: 27 September 2013

Drosera x californica 'Portland Sunrise' (Fig. 6) is an apparent hybrid between *Drosera filiformis* and *Drosera tracyi* that resembles *D. filiformis* more than the horticultural hybrid *Drosera x californica* 'California Sunset' (Robinson 1981). The exact history of the plant is not known. In 2006 or 2007, Djoni purchased a plant labeled "Florida Giant Dewthread" from a vendor at the Portland Saturday Market and planted it in her backyard bog. She was told it was sterile. After a few years it spread to a large area in her bog via seeds (Fig. 7). Upon further investigation and comparison with another plant purchased from the same vendor at the Portland Saturday Market in 2012, she found that her plants were redder and shorter than expected for *Drosera filiformis* "Florida Giant" (D'Amato 1998), the plant name specified on the original label. The flowers are typical of *Drosera x californica* (Fig. 8), although they are smaller than those of *Drosera filiformis* "Florida Giant". We have not compared them side-to-side with *D. 'California Sunset'*. In 2013, when Djoni donated seeds from her plants to the ICPS Seed Bank, John queried her as to exactly what they were so they could be listed correctly. She sent him photos and some plants weeded out of her bog. We decided to list them as *Drosera filiformis x tracyi* while the plants were studied further.

The primary diagnostic difference between *Drosera x californica* 'Portland Sunrise' and both *D. x californica* 'California Sunset' and *D. filiformis* "Florida Giant" is the red pigment in the tentacle heads of *D. 'Portland Sunrise'* does not fade in strong sunlight the way it does in the other two plants. This gives *D. 'Portland Sunrise'* a red cast while the others are pink. All three have identical bright red tentacle heads when they first form. Some plants of *D. 'Portland Sunrise'* have red pigment at the tip of the tentacle stalk as seen in northern *D. filiformis*. The higher amount of red pigment in the tentacles of *D. 'Portland Sunrise'* makes the plant look like an extremely robust *D. filiformis*. Other distinct attributes of *D. 'Portland Sunrise'* are the plants are shorter and tend to clump more than *D. 'California Sunset'* and *D. filiformis* "Florida Giant" when grown under our conditions.

We chose the name *Drosera* 'Portland Sunrise' because the plants from seed appear to have been selected by Portland, Oregon, winters to have more of the *D. filiformis* character than seen in *D. 'California Sunset'* or *D. filiformis* "Florida Giant". It is possible that this cultivar arose following a back cross with *D. filiformis* but it could not have occurred in Djoni's bog since she did not have any other *D. filiformis*-like plants until late 2012 when she acquired a *D. filiformis* "Florida Giant".

The name *Drosera* 'Portland Sunrise' does not conflict with the hybrids *Drosera* 'Ambrosia' and 'Dreamsicle' described by Barnes (2011) because the aspect of the plants are different and we believe the *D. filiformis* parent had to be from a northern population of the species. The red Florida *D. filiformis* taxon will not survive outside over winter here. We use the hybrid name *Drosera* $\times$ *californica* because we accept that *D. filiformis* and *D. tracyi* are separate species (Check 1993; Rice 2011) in spite of some authors arguing that the species description of *D. tracyi* is inadequate (Schnell 1995). Use of the hybrid name is optional. The name applies to any plants that meet the description irrespective of method propagated. Some plants from seed will not agree with the description.



Figure 8: Flower of *Drosera* $\times$ *californica* 'Portland Sunrise'. 11-photo composite image by John Brittnacher.

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BOOK REVIEW

D'Amato, P. 2013. *The Savage Garden: Cultivating Carnivorous Plants* (revised). Softcover, 374 + x pp., approximately 290 figures, most in color, 15cm x 23 cm (6" x 9"). ISBN: 978-1-60774-410-8. Ten Speed Press. \$25.99, signed copies from californiacarnivores.com.

Reviewed by Barry Rice

For the attention-deficit crowd out there, here is your review—Buy the book; you'll need it. For you, for a family member, for a friend. For whomever wants to grow carnivorous plants.

As for those whom would like to know more, here are some details...

In 1998, Peter D'Amato published "The Savage Garden." The importance of that book for carnivorous plant horticulturists cannot be overstated. At that time, nearly all the carnivorous plant books were either technical treatments or focused on the plants in the wild. Adrian Slack's books were dedicated to horticulture, but having been published in 1979 and 1986, were woefully dated. Years of growing (and killing) carnivorous plants had earned us hard-won lessons on how to do things right—or at least better. But unless you had complete sets of issues of all the journals of the various carnivorous plant societies, as well as electronic files storing all the chatter on the Internet, there was no way to review the best-practices in carnivorous plant growing.

Peter's¹ first book filled that void. He presented an excellent summary of what we all had learned about growing carnivorous plants. The critical information was all in one place, for easy capture and digestion.

But that was fifteen years ago. Once again, we need a new reference book on carnivorous plant growing. Indeed, so much of what we know about carnivorous plants has changed that in some ways it is almost a new hobby. For example, the numbers of species, hybrids, and cultivars have exploded! The Savage Garden had become dated.

Happily, Peter has come forth with a major revision of his first book. Similar in format to the first, it is about 20% bigger, and of course, loaded with current information. So yes, even if you have a copy of his first book (and really, who doesn't?), you absolutely must get this new version.

So what is in the book?

There are no big surprises—the book begins with a dozen introductory pages, and then follows with 60 pages of cultivation nuts and bolts—soil mixes, light, water, dormancy, growing methods, etc. Everything is covered in detail—it's all there. And then, in 275 nitrogen-rich pages, Peter describes in gory detail just about all we know about carnivorous plant cultivation. Finally, he concludes with a dozen pages on other resources. Lovely illustrations are found on nearly every page.

Peter's writing is smooth and easy. He knows his way around the English language, and there's not a stilted sentence to be found. Also, you will find plenty of Peterisms, by which I mean strangely evocative phrases that remind us that investing so much energy into growing plants because they are carnivorous, is well, kind of kooky:

"Mother Nature hopefully had psychiatric care after she designed the sundews."

"This is the plant made famous by Charles Darwin's tireless and hideous experiments on it."

"The unhappy face of a grasshopper as it is digested alive."

"...*Nepenthes lowii*, a true crapivorous plant!"

¹As I review this work, I will make no attempt to hide the fact that Peter D'Amato and I are good friends, hence my addressing him as "Peter." However, I maintain that my review is impartial, and that I have no personal financial interest in the sales of his books.

I can imagine Peter gently cackling as wrote these lines. So many of us, who have been involved in carnivorous plants for decades, have grown complacent about these astonishing plants. Not Peter—even after all these years, he obviously finds new delights in their strange and sinister habits. He reminds you of why we love these plants.

Of course, everyone expects a reviewer to throw some mud at the work. So let me do my best. The Savage Garden is not a compendium of all knowledge. For example, those interested in abandoning old school moss-and-pots horticulture for tissue culture will find almost no guidance on *in vitro* methods. Also, the developing and rapidly changing technology of LEDs, in the context of growing carnivorous plants, is barely mentioned. Beyond that, his work is generally complete.

Also, if I wear my scientist hat while reading this book, I can find a few things to complain about. While Peter gets most of his science right, the occasional misstep finds its way into the text. For example, when discussing *Darlingtonia*, he notes that only one population occurs in the Sierra Nevada, when in fact this mountain range is home to three well-known populations in two counties (while I know of more than 18 sites, grouped in seven clusters, in Plumas, Nevada, and Sierra counties). But really, it would be a poor choice for anyone to turn to a horticultural book as a reference work on scientific minutia, just as one would not turn to a scientific paper for solid hints on cultivation. Remember the book's parallel title is "Cultivating Carnivorous Plants." Peter's science, in regards to cultivation, is robust.

Indeed, I would argue that Peter keeps up with science very well, for examples he includes Robert Gibson's recent new findings on the *Drosera peltata* group, myriad new species of *Nepenthes* and other genera, and so on. Do I agree with all his taxonomy? No, but they are scientifically defensible.

One final topic that is pleasing to see. For the last decade, carnivorous plant horticulturists have been frustrated by the horticultural code for cultivars. In particular, horticulturists would like to use the system of grexes (grexes). Alas, the use of grexes is only available to orchid growers. No matter how often I have tried to explain that this ruling was made by the International Commission for the Nomenclature of Cultivated Plants, people have continued to blame the International Carnivorous Plant Society for this restriction. Peter gets his facts right here, and in fact argues for the rogue adoption of grexes by carnivorous plant horticulturists. This is probably a good thing—after all, there will be no change in the *status quo* system if everyone appears to be satisfied with it, when in fact it is frustrating to so many.

So here is my prescription, and it is simple. Buy the book. In fact, you should buy the book directly from the California Carnivores web site, because you can request to have it be autographed to you.

There's not a whole lot better than having a great book, signed by the author, directly to you.

You have your marching orders. Now go.

CULTIVAR NAMES REGISTERED IN 2013

<i>Cephalotus</i> ‘Clayton’s T Rex’ C.Clayton, Carniv.Pl.Newslett.42:145 (2013)	26.Dec.
<i>Cephalotus</i> ‘Donna’s Destiny’ C.Clayton, <i>Cephalotus Teratol.Abnorm.L.</i> :21 (2011)	11.Jun.
<i>Cephalotus</i> ‘Tina’s Hallelujah Trumpets’ C.Clayton, <i>Cephalotus Teratol.Abnorm.L.</i> :22 (2011)	11.Jun.
<i>Cephalotus</i> ‘Jason’s Arks’ C.Clayton, <i>Cephalotus Teratol.Abnorm.L.</i> :23 (2011)	11.Jun.
<i>Dionaea</i> ‘A2’ H.v.Schmeling, Bailey & McPherson, <i>Dionaea</i> :156 (2013)	15.May
<i>D.</i> ‘Adentate’ C.Paul, Bailey & McPherson, <i>Dionaea</i> :159 (2013)	15.May
<i>D.</i> ‘All Green’ C.Clayton, Bailey & McPherson, <i>Dionaea</i> :164 (2013)	29.May
<i>D.</i> ‘Angelwings’ S.Leonhardt, Bailey & McPherson, <i>Dionaea</i> :166 (2013)	15.May
<i>D.</i> ‘BCP clone X11’ K.Pasek, Bailey & McPherson, <i>Dionaea</i> :174 (2013)	15.May
<i>D.</i> ‘Bec de Lièvre’ S.Bonnet, Carniv.Pl.Newslett.42:146 (2013)	26.Dec.
<i>D.</i> ‘Big Mouth’ C.Clayton, T.Camilleri, Carniv.Pl.:17 (1998)	22.May
<i>D.</i> ‘Big Teeth Red Giant’ K.Pasek, Bailey & McPherson, <i>Dionaea</i> :178 (2013)	15.May
<i>D.</i> ‘Bimbo’ E.Koenig, Bailey & McPherson, <i>Dionaea</i> :180 (2013)	15.May
<i>D.</i> ‘Biohazard’ C.Klein, Bailey & McPherson, <i>Dionaea</i> :182 (2013)	15.May
<i>D.</i> ‘Bristle Tooth’ C.Clayton, Bailey & McPherson, <i>Dionaea</i> :188 (2013)	29.May
<i>D.</i> ‘BZ 1955’ R.Ziemer, Bailey & McPherson, <i>Dionaea</i> :154 (2013)	15.May
<i>D.</i> ‘Cheerleader’ D.Conner, Carniv.Pl.Newslett.42:150 (2013)	26.Dec.
<i>D.</i> ‘Crested Petioles’ C.Clayton, Bailey & McPherson, <i>Dionaea</i> :194 (2013)	29.May
<i>D.</i> ‘Crocodile’ M.Farina, Bailey & McPherson, <i>Dionaea</i> :196 (2013)	06.Jun.
<i>D.</i> ‘Cross Teeth’ C.Clayton, Bailey & McPherson, <i>Dionaea</i> :198 (2013)	29.May
<i>D.</i> ‘Cudo’ J. & M. Srba, Bailey & McPherson, <i>Dionaea</i> :200 (2013)	22.May
<i>D.</i> ‘DC All Red’ S.Doonan & M.Miller, Bailey & McPherson, <i>Dionaea</i> :205 (2013)	15.May
<i>D.</i> ‘DC XL’ S.Doonan & M.Miller, Bailey & McPherson, <i>Dionaea</i> :206 (2013)	15.May
<i>D.</i> ‘Dracula’ T.Cox, Bailey & McPherson, <i>Dionaea</i> :212 (2013)	15.May
<i>D.</i> ‘ERROR’ M.Maier, Bailey & McPherson, <i>Dionaea</i> :214 (2013)	15.May
<i>D.</i> ‘Fangzahn’ E.Koenig, Bailey & McPherson, <i>Dionaea</i> :216 (2013)	15.May
<i>D.</i> ‘FTS Crimson Sawtooth’ M.Miller, Bailey & McPherson, <i>Dionaea</i> :220 (2013)	15.May
<i>D.</i> ‘FTS Flaming Lips’ M.Miller, Bailey & McPherson, <i>Dionaea</i> :222 (2013)	15.May
<i>D.</i> ‘FTS Lunatic Fringe’ M.Miller, Bailey & McPherson, <i>Dionaea</i> :224 (2013)	15.May
<i>D.</i> ‘FTS Maroon Monster’ M.Miller, Bailey & McPherson, <i>Dionaea</i> :226 (2013)	15.May
<i>D.</i> ‘FTS Purple Ambush’ M.Miller, Bailey & McPherson, <i>Dionaea</i> :228 (2013)	15.May
<i>D.</i> ‘FTS Shogun Star’ M.Miller, Bailey & McPherson, <i>Dionaea</i> :230 (2013)	15.May
<i>D.</i> ‘FTS Yellow’ M.Miller, Bailey & McPherson, <i>Dionaea</i> :232 (2013)	15.May
<i>D.</i> ‘Giant Clam’ J. & M. Srba, Bailey & McPherson, <i>Dionaea</i> :238 (2013)	22.May
<i>D.</i> ‘Ginormous’ D.Collingsworth, Carniv.Pl.Newslett.42:25 (2013)	30.Mar.
<i>D.</i> ‘Green Schuppenstiel’ M.Maier, Bailey & McPherson, <i>Dionaea</i> :244 (2013)	15.May
<i>D.</i> ‘Green Wizard’ G.Hoogenstrijd, Bailey & McPherson, <i>Dionaea</i> :246 (2013)	15.May
<i>D.</i> ‘Gremlin’ D.Collingsworth, Carniv.Pl.Newslett.42:24 (2013)	30.Mar.
<i>D.</i> ‘Harmony’ C.Klein, S.Glied, C.Paul & M.Stöckl, Bailey & McPherson, <i>Dionaea</i> :248 (2013)	15.May
<i>D.</i> ‘Iris’ S.Bonnet, Carniv.Pl.Newslett.42:146 (2013)	26.Dec.
<i>D.</i> ‘Jaws Smiley’ G.Hoogenstrijd, Bailey & McPherson, <i>Dionaea</i> :254 (2013)	15.May
<i>D.</i> ‘Long Petiole’ C.Clayton, Bailey & McPherson, <i>Dionaea</i> :261 (2013)	29.May
<i>D.</i> ‘Low Giant’ C.Clayton, Bailey & McPherson, <i>Dionaea</i> :263 (2013)	29.May
<i>D.</i> ‘Master of Disaster’ G.Hoogenstrijd, Bailey & McPherson, <i>Dionaea</i> :264 (2013)	15.May

<i>D.</i> ‘Miss Pimbêche’ L.Blacher, Bailey & McPherson, <i>Dionaea</i> :270 (2013)	07.May
<i>D.</i> ‘MK 1979’ M.King, Bailey & McPherson, <i>Dionaea</i> :155 (2013)	15.May
<i>D.</i> ‘Olivgrün’ E.Koenig, Bailey & McPherson, <i>Dionaea</i> :272 (2013)	15.May
<i>D.</i> ‘Orange Neat Trap’ J.H.Lee, <i>Carniv.Pl.Newslett.</i> 42:69 (2013)	30.Jun.
<i>D.</i> ‘Paradisica’ C.Clayton, Bailey & McPherson, <i>Dionaea</i> :274 (2013)	22.May
<i>D.</i> ‘Phalanx’ M.King, Bailey & McPherson, <i>Dionaea</i> :278 (2013)	15.May
<i>D.</i> ‘Pink Venus’ C.Clayton, Bailey & McPherson, <i>Dionaea</i> :280 (2013)	29.May
<i>D.</i> ‘Pluto’ M.Maier, Bailey & McPherson, <i>Dionaea</i> :282 (2013)	15.May
<i>D.</i> ‘Red Devil’ L.Blacher, Bailey & McPherson, <i>Dionaea</i> :286 (2013)	07.May
<i>D.</i> ‘Red Fused Petiole’ K.Pasek, Bailey & McPherson, <i>Dionaea</i> :173 (2013)	15.May
<i>D.</i> ‘Red Micro-Teeth’ L.Blacher, Bailey & McPherson, <i>Dionaea</i> :288 (2013)	07.May
<i>D.</i> ‘Red Neat Trap’ J.H.Lee, <i>Carniv.Pl.Newslett.</i> 42:68 (2013)	30.Jun.
<i>D.</i> ‘Red Pluto’ M.Maier, Bailey & McPherson, <i>Dionaea</i> :292 (2013)	15.May
<i>D.</i> ‘Rose’ M.Maier, Bailey & McPherson, <i>Dionaea</i> :294 (2013)	15.May
<i>D.</i> ‘Rouge Sombre’ J.-J. Labat, Bailey & McPherson, <i>Dionaea</i> :295 (2013)	29.May
<i>D.</i> ‘Schuppenstiel I’ E.Koenig, Bailey & McPherson, <i>Dionaea</i> :304 (2013)	15.May
<i>D.</i> ‘Schuppenstiel II’ S.Leonhardt, Bailey & McPherson, <i>Dionaea</i> :306 (2013)	15.May
<i>D.</i> ‘Small Fast’ J.H.Lee, <i>Carniv.Pl.Newslett.</i> 42:70 (2013)	30.Jun.
<i>D.</i> ‘Snake Dentition’ S.Leonhardt, Bailey & McPherson, <i>Dionaea</i> :308 (2013)	15.May
<i>D.</i> ‘South West Giant’ A.Pearce, Bailey & McPherson, <i>Dionaea</i> :309 (2013)	22.May
<i>D.</i> ‘Spotty’ S.Lenssen, Bailey & McPherson, <i>Dionaea</i> :312 (2013)	15.May
<i>D.</i> ‘St. Patrick’s Beard’ D.Conner, <i>Carniv.Pl.Newslett.</i> 42:151 (2013)	26.Dec.
<i>D.</i> ‘Sunrise’ T.Cox, Bailey & McPherson, <i>Dionaea</i> :314 (2013)	06.Jun.
<i>D.</i> ‘Tiger Fangs’ M.Stoeckl, Bailey & McPherson, <i>Dionaea</i> :316 (2013)	15.May
<i>D.</i> ‘Trichterfalle’ E.Koenig, Bailey & McPherson, <i>Dionaea</i> :318 (2013)	15.May
<i>D.</i> ‘Triton’ M.Maier, Bailey & McPherson, <i>Dionaea</i> :320 (2013)	15.May
<i>D.</i> ‘UK I’ C.Klein, Bailey & McPherson, <i>Dionaea</i> :322 (2013)	15.May
<i>D.</i> ‘UK II’ C.Klein, Bailey & McPherson, <i>Dionaea</i> :323 (2013)	15.May
<i>D.</i> ‘Umgekrepelt’ M.Maier, Bailey & McPherson, <i>Dionaea</i> :324 (2013)	15.May
<i>D.</i> ‘Viper Trap’ J.H.Lee, <i>Carniv.Pl.Newslett.</i> 42:68 (2013)	30.Jun.
<i>D.</i> ‘Werewolf’ G.Hoogenstrijd, Bailey & McPherson, <i>Dionaea</i> :330 (2013)	15.May
<i>D.</i> ‘Whale’ G.Hoogenstrijd, Bailey & McPherson, <i>Dionaea</i> :331 (2013)	15.May
<i>D.</i> ‘WIP Slim Snapper’ B.Hanrahan & S.Doonan, Bailey & McPherson, <i>Dionaea</i> :332 (2013)	15.May
<i>D.</i> ‘Zickzackkiefen’ E.Koenig, Bailey & McPherson, <i>Dionaea</i> :333 (2013)	15.May
<i>Nepenthes</i> ‘The Succubus’ M.Kaelin, <i>Carniv.Pl.Newslett.</i> 42:27 (2013)	30.Mar.
<i>Pinguicula</i> ‘Giant Green Violet’ J.H.Lee, <i>Carniv.Pl.Newslett.</i> 42:67 (2013)	30.Jun.
<i>Sarracenia</i> ‘Bob Hanrahan’ D.Collingsworth & P.D’Amato, <i>Carniv.Pl.Newslett.</i> 42:108 (2013)	11.Oct.
<i>Sarracenia</i> ‘Dedication’ S.Little, <i>Pl.Carniv.</i> 35:21 (2013)	30.Jun.
<i>Sarracenia</i> ‘Mesa Exotics’ P.Faulisi, <i>Carniv.Pl.Newslett.</i> 42:147 (2013)	26.Dec.
<i>Sarracenia</i> ‘Narrow Throat’ J.H.Lee, <i>Carniv.Pl.Newslett.</i> 42:66 (2013)	30.Jun.
<i>Sarracenia</i> ‘Purple Velvet’ S.Amoroso, <i>Carniv.Pl.Newslett.</i> 42:24 (2013)	30.Mar.
<i>Sarracenia</i> ‘Stingray’ P.Faulisi, <i>Carniv.Pl.Newslett.</i> 42:148 (2013)	26.Dec.
<i>Sarracenia</i> ‘Vintner’s Treasure’ P.Faulisi, <i>Carniv.Pl.Newslett.</i> 42:148 (2013)	26.Dec.
<i>Sarracenia</i> ‘Waccamaw’ D.Gray, <i>Carniv.Pl.Newslett.</i> 42:107 (2013)	11.Oct.

LITERATURE REVIEWS

By John Brittnacher

Furches, M.S., Small, R.L., and Furches, A. 2013. Genetic diversity in three endangered pitcher plant species (*Sarracenia*; Sarraceniaceae) is lower than widespread congeners. *American Journal of Botany* 100(10): 2092-2101.

The U.S. Fish & Wildlife Service lists *Sarracenia alabamensis*, *S. oreophila*, and *S. jonesii* as endangered species. To determine the genetic diversity or genetic health within these species this study sampled between 4-15 clumps (*i.e.* presumed individuals) from 3 of the about 6 *S. alabamensis* sites known, 8 of the 40 *S. oreophila* sites, and 6 of the 10 *S. jonesii* sites. The number of clumps per site varied as half the sites had very few plants. The *S. alabamensis* sites had 8 to 12 clumps of plants each, 3 of the *S. oreophila* sites had 5 to 11 clumps, and 3 of the *S. jonesii* sites had 4 to 6 clumps. The authors determined chloroplast non-coding DNA sequences and DNA microsatellite data from small leaf samples. (Non-coding DNA sequences and the small tandem repeat DNA sequences that constitute the “microsatellites” evolve very quickly. The microsatellite procedure consists of assessing the size of selected microsatellites and not their actual DNA sequences.) For the chloroplast DNA sequences recovered in the study, each of the species had a unique set of variants. There was no variation within the *S. jonesii* plants while there were two variants within *S. alabamensis*. The North Carolina and Georgia *S. oreophila* sites near Lake Chatuge had the same unique variant while the Alabama sites had 13 variants including one site with 6 variants. On the other hand, *S. alabamensis* was found to have the highest level of microsatellite variation although at the two smaller sites there was significant inbreeding measured. *S. oreophila* had the lowest microsatellite variation and significant inbreeding at half the sites. *S. jonesii* had intermediate microsatellite variation and significant inbreeding at 2 of 6 sites. Comparing their genetic data and their field observations, the authors conclude that the current conservation status of a species is not a predictor of their current genetic status. Although this is true, they did not consider that high inbreeding coefficients indicate the current populations are too small to maintain the amount of variation they measured. Among these species, *S. alabamensis* is the most threatened owing to it being present only in a few small sites, many of them threatened with degradation. *S. oreophila* is in somewhat better shape because there are more sites but those sites are equally threatened. *S. jonesii* is much less likely to become extinct in its native sites because they are within a state park, wilderness area, or private reserve.

Furches, M.S., Small, R.L., and Furches, A. 2013. Hybridization leads to interspecific gene flow in *Sarracenia* (Sarraceniaceae). *American Journal of Botany* 100(10): 2085-2091.

The genus *Sarracenia* consists of 15 species and subspecies, all of which are capable of hybridizing. There are many locations where two or more *Sarracenia* species coexist and hybrids are found. This study addresses the question of whether effective gene flow is occurring between the species where they coexist. It used microsatellite DNA because microsatellite analysis is a relatively inexpensive and easy way to characterize a large number of samples within species and between very closely related species. The authors analyzed 292 plants sampled randomly from a site in Washington County, Alabama, that has *Sarracenia leucophylla*, *S. alata*, and *S. rubra* subsp. *wherryi*. As controls they sampled 5, 9, and 6 individuals from those species respectively from sites 250 km, 80 km, and 15 km away respectively that only had that one species. Their results showed no individuals at the multispecies site as “pure” as at the single species control sites. This makes sense because they could not know whether the sample of microsatellites at the control sites were fully indicative of the whole species.

They would have needed to do a full species survey of microsatellites for better control data. They used 85% or higher “pure” as a cutoff for pure species in the multispecies site in order to not overestimate the proportion of hybrids. They used 40 to 60% each of two species and less than 20% of the third to classify first generation hybrids. The remaining plants were classified as backcross or complex hybrids based on the microsatellite percentages from three species. Using these classifications they found 63% of the plants were pure species, 13% were first generation hybrids, 19% were backcross hybrids, and 5% were complex hybrids. They did not address the issue of how a taxonomist would have classified the plants in each category, although they appear to have had the data to do so. The results indicate that gene flow can and does happen between *Sarracenia* species under natural conditions. The implication of this work is that management strategies for conservation of wild mixed species *Sarracenia* sites must take into account factors that have been shown to increase hybridization.

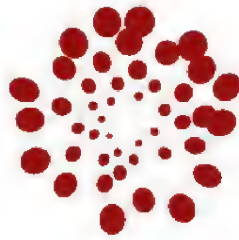
Carstens, B.C., and Satler, J.D. 2013. The carnivorous plant described as *Sarracenia alata* contains two cryptic species. *Biological Journal of the Linnean Society* 109: 737–746.

This paper addresses the issue of whether it is time for genetic data to be used for taxonomic classification in cases where there are no physical characters to distinguish “species”. It uses DNA sequence data from Zellmer *et al.* (2012) along with new data filling in missing data from the earlier study in order to make the results more robust. This study, like the previous study, is a *tour de force* of cutting edge analysis techniques and is important as a demonstration of their use. However, it has the same major flaw as the previous paper. They assume the eastern population of *Sarracenia alata* is genetically isolated from the four *Sarracenia* species with which it co-occurs. Many authors have noted that interspecific hybrids are found in the eastern *S. alata* populations, making introgression between species possible. As reviewed above, Furches *et al.* (2013) studied a population of three *Sarracenia* species, including eastern *S. alata*, and showed that hybridization appears to have resulted in gene flow between species. In order for the conclusions in this paper to be valid they have to show the differences they found between the eastern and western populations of *S. alata* are based on genetic variants unique to *S. alata* and not a result of introgression from other species. The authors promise a species description to be published based on purely genetic data providing a name for the western population of *S. alata*.

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- Furches, M.S., Small, R.L., and Furches, A. 2013. Hybridization leads to interspecific gene flow in *Sarracenia* (Sarraceniaceae). *Am. J. Bot.* 100(10): 2085-2091.
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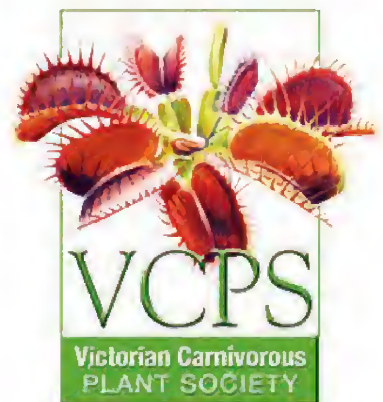
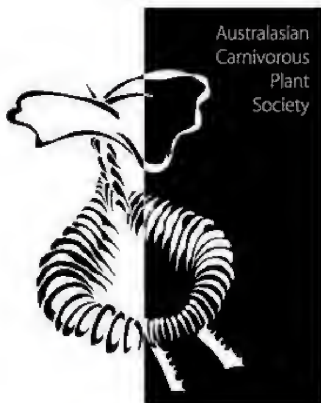
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